



Case report

Risks of non-lethal weapon use: Case studies of three French victims of stinger grenades

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ARTICLE INFO

Article history:

Received 8 June 2010

Received in revised form 1 June 2012

Accepted 22 August 2012

Available online 13 September 2012

Keywords:

Non-lethal weapons

Blunt force injury

Clinical forensic pathology

Ballistics

ABSTRACT

The development of non-lethal weapons started in the 1960s. In France, they have been used by the police for about 10 years.

We relate the cases of three French women, victims of stinger grenades, non-lethal weapons recently adopted by the French law enforcement to distract and disperse crowds. The three victims presented serious injuries requiring emergency surgical care. One lost her eye.

Based on these cases, we discuss the lethal character of these weapons and propose measures to be taken to prevent their dramatic consequences.

Although the danger is obviously less than for firearms, stinger grenades are nonetheless potentially lethal and cause serious physical injuries.

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1. Introduction

In most countries, since the 1960s, non-lethal weapons are being developed under uncontested established development policies [1,2]. They are defined as “*discriminatory weapons that are explicitly designed for and mainly used to incapacitate personnel and equipment while minimizing the risk of death, permanent injury to people and undesirable damage to property and the environment.*” [3]. They have taken a central place in military thinking since 1990 but have only been actually used by the French police for about 10 years. The weapons are designed to incapacitate a violent and/or dangerous individual while minimizing the risk of permanent injuries or death: that is as a temporary weapon used to neutralize, not fatal in normal use. Several articles [5,6] have already been published about the potential risk of death by these less-lethal weapons, in particular a recent report in France by the “National Commission of Business Ethics and Safety”, which advocates “*the Flashball® should not be used during demonstrations in public places, except on rare occasions which have yet to be defined*” [4].

There are several types, the most well-known and controversial being the Taser® and Flashball®. Others ammunitions are less known like the “bean bag”, projectiles fired from a pump shotgun or a 12 gauge shot-gun and used in American policing since the 1970s. These ammunitions are composed of a fabric bag containing about 40 g of Nr-9 lead shot pellets.

Rubber stinger grenades are manual protective devices (hereafter referred to as DMPs) and are a new category of less-lethal weapons, used by French law enforcement. These weapons enable law enforcement officers to distract and disperse a crowd. Up to now no comments or reports concerning their side effects and potential risks have been issued. Does a risk of death in the case of their misuse as for the Gomm-Cogne gun and Flashball® exist? We will study the case of three French young women, victims of stinger grenades to try and find an answer.

2. Report of three cases

2.1. Case 1

A young woman was riding her bicycle in a neighborhood where a demonstration was going on when she received two impacts from a DMP on her face and thigh. She immediately went to the University Hospital. The physical examination revealed two types of recent wounds, inflicted at the same time:

- Her face suffered from a large seeping wound on the right mandible horizontal branch and hypoesthesia, requiring emergency suture by the facial surgeon under local anesthesia (Fig. 1). There was no associated bone fracture.
- The left thigh presented a large bruise (Fig. 2).

She was prescribed nurse's care and blended/liquid foods for 10 days. The forensic examination done the same day emphasized the contused injuries and suggested them being due to a hard and

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Fig. 1. A large seeping wound under the right mandible horizontal branch.



Fig. 3. The left eye which presented a transfixing wound, after the first surgical intervention.



Fig. 2. A large bruise at the left thigh.

small-sized object. It also foresaw significant cosmetic after-effects. The inquest subsequently implied a DPM blast as the origin, supported by the single rectangular hematoma on the thigh.

2.2. Case 2

A student received a shot in the face as she passed near an event which involved the police on her way home. The young woman was taken to the University Hospital by emergency ambulance.

The results of clinical examination and CT scan of the skull showed a transfixing wound in the left eye, a scleral wound, a complex fracture of the orbit ("blow-out") with involvement of the orbital floor and roof and the medial wall. The fracture extended to the upper ethmoido-frontal junction and toward the frontal sinus's rear wall bone with a cerebrospinal fluid fistula and injury to the optic canal but leaving the nerve intact.

Her state required emergency surgery under general anesthesia and several days of hospitalization. The collapse of the eye and orbital cavity shows how violent the trauma was (Fig. 3).

Her state degenerated with atrophy of the eye. This required surgery with enucleation, followed by seven operations to reconstruct the eye with prosthesis. Besides the blindness and the major cosmetic injuries, the victim suffered from impaired hearing, anosmia and headaches.

The inquest implies once again a piece of rubber stinger grenade.

2.3. Case 3

Another young girl was near a crowd. She heard a bang and then felt a sharp pain in her left leg, corresponding to a bruised wound about 6 cm in diameter. She was brought immediately to the University Hospital where she had emergency surgery under local anesthesia. During the same episode, the victim's friend also suffered large bruises on her legs, while an eye-witness suffered from second-degree burns and bruises on the upper limbs. The inquest implies also a piece of rubber stinger grenade.

3. Discussion

In the current observations, we describe severe injuries caused by a French new non-lethal weapon, the rubber stinger grenade. The cartridge of the grenade contains 18 trapezoidal rubber projectiles, each weighing approximately 10 g (Fig. 4). Its base, weighing 19 g, is the powder carrier that contains the pyrotechnical charge (3 g explosive compound). The charge is packed in a tube, which sits in the powder carrier. The whole canister is covered with a plastic sheath that retracts and is screwed to an ignition plug (hard plastic with ridges and indentations). Simply removing the pin on the plug allows deployment. Two types of ignition plugs are available: a distributor cap for manual operation

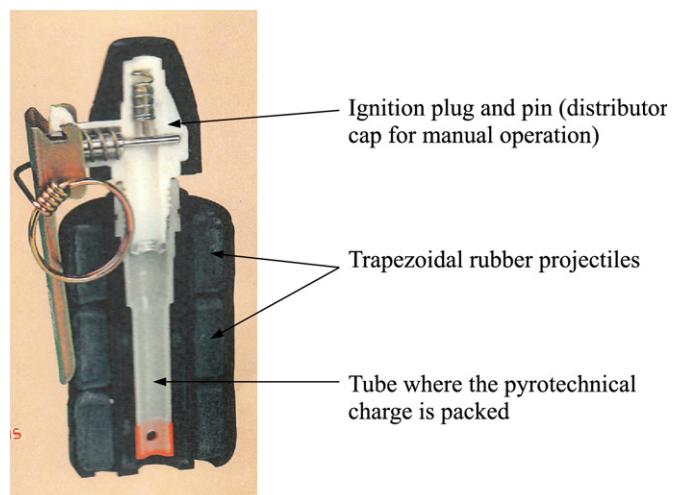


Fig. 4. Rubber stinger grenade (longitudinal cut) made of three different parts: the cartridge, the base and the pyrotechnical charge.

as for a hand grenade, or a lighter plug for use with the launcher as for a rifle grenade.

The main desired effects of these weapons are:

- Detonation of 165 dB.
- Slight bruising and severe pain in the feet associated with the rubber projectiles traveling at 10 m per second over a distance of about 5 m.

Theoretically, a specific training and a certificate of proficiency are required to use them, and only then in the case of self-defense at close range. In France, they have been available to law enforcement in situations of urban violence or public disorder since 2004. A transmission of a memorandum from the Director of Central Security Service dated December 24, 2004 states that “*the DMP must be launched by hand and rolled on the ground towards the center of the group to disorient it, so as to avoid accidental injury to police officers or aggressors in the eyes or at the throat (...) these requirements are mandatory*” [4].

To our knowledge, few cases of severe secondary trauma from the so-called non-lethal weapons have been released. The current cases reports testify of the dangerousness of this weapon. In the case 2, three hypotheses were retained to explain how the impact could have occurred at head-level:

- The DMP exploded in the air close to the victim's head.
- The ignition plug was abnormally detached from the cap although no such defect has been detected in all the DMPs tested.
- A second shot was launched at the explosion of the first DMP, close to the victim's head. This hypothesis seems unlikely since a very high speed of this second shot is required to cause the observed lesions.

The expertise on DMP's compliance used on the day of the demonstration confirmed the non-lethality of the grenade. Even so, the fragments were smaller than the minimum recommended (10 mm instead of 15).

In case 3, after investigation, it appeared that the DMP has been thrown from the front window of a moving vehicle, also causing a 2 m high neon to fall to the ground. The rubber rectangles of the DPM seem to have impacted both directly on the victims and by ricochet.

In order to evaluate the danger and the potential lethal risk of this grenade we can compare it to other weapons in the same category that use rubber or plastic bullets such as Flashball guns, Gomm-Cogne guns or even “bean bags”. As far as these latter are concerned, the international literature reports numerous cases of severe or lethal injuries [7–9].

Rubber and plastic bullets have been used for more than 40 years in many armed conflicts. In the 1970s in Northern Ireland, Millar [10] counted 90 people injured and 2 actually killed from these bullets. The British army replaced the rubber bullets by plastic bullets in 1973. In a study comparing injuries caused by plastic bullets with those caused by rubber bullets, Rocke [11] concluded that more severe injuries were more common with rubber than plastic bullets. But this conclusion is refuted by Owen and Rosenhead [12]. However, following the firing of plastic bullets, Rocke [11] recorded 99 victims of these missiles. He reported 10 people struck in the face, 31 on the head and cervical regions, 10 on the chest and 9 in the abdominal region. This study showed that 6 victims suffered from fractures and brain injuries causing 3 deaths, 5 suffered from facial fractures, one was struck in the orbital region and lost her eye and one had rib fractures. At the same time, Shaw [13] reported 3 cases of children hit in the chest by this type of projectiles resulting in severe trauma to the thorax and lungs, with no associated fractures. Ten years later, Israeli

medical teams [14,15] also counted numerous victims of plastic or rubber missiles used during the intifada between 1987 and 1993 and later in the 2000 conflict, causing several deaths (more than 20 during the first intifada) [14].

These weapons have been used outside of all armed conflicts in many countries for the last 20 years. In South Africa, Cohen [16] identified 5 victims from plastic bullets, all treated for severe facial injuries with multiple skin abrasions and mandibular fractures plus one victim who lost her eye. In 2000 a French team [17] reported 5 cases of extremely serious facial trauma due to rubber bullets fired from weapons such as the GC27 and the GC54, standard French less-lethal rubber-bullets guns: two victims received an orbital impact causing irreversible visual loss, two a cheek impact and one an impact on the frontal region. All suffered major cosmetic prejudice.

The majority of the authors seem to privilege the topography of the impact as the predominant factor in the weapons' lethal or destructive potential. The vital, functional and cosmetic prognosis of contused visceral injuries, associated or not with bones fractures, depends on the impact zone:

- The cephalic region appears to be the most lethal.
- The thoracic region associated with pulmonary and heart contusions can also be lethal.
- The cervical region, where an impact in the trachea can cause skin and vascular lesions, and even immediate suffocation.
- Sensitive areas (groin, eyes, mouth, etc.) where the injuries can lead to functional loss and unsightly scars as seen in our three cases.

Distance and kinetic energy seem to be important elements to take into account as shown by numerous reports of lethal cases [9,18,19]. Faller-Maquardt [18] reported a death case after a point blanc shot in the mouth with a self-defense handgun using rubber bullets of the type Mini Gomm-Cogne. More recently, Voiglio et al. [19] described the case of a woman who died after several 7 mm rubber bullets shot from a Mini Gomm-Cogne, striking her chest. The impact caused ventricular cardiac tamponade associated with multiple rib fractures and hemothorax. She died quickly from heart failure. However, the projectiles of the various cases reported in the literature present very variable kinetic energy while the injuries caused by these projectiles remain severe and possibly lethal. The ballistic tests concerning the projectiles of fire of rubber stinger grenades show a kinetic energy between 67 J and 104 J, those concerning the Flashball a kinetic energy between 400 J and 775 J [7]. Khonsari et al. [17] reported a kinetic energy of munitions of less than 24 J for the one and less than 50 J for the other one.

In view of these observations and data from literature, the term “non-lethal” should be forbidden and replaced by “reduced lethality” because the term “non-lethal” implies the absence of any death, which seems to be impossible. Although it is difficult to remove offensive or disabling power from such a weapon because of its very nature, there are several solutions available to reduce their potential to kill or cause dramatic damage. The first is obviously the establishment and enforcement of strict conditions of use. For DMPs, the prohibition of launching into the air or from a moving vehicle is of prime importance, as shown by our observations of incorrect launching.

The second but not lesser solution is the training of law enforcement by providing all the information on the risks of injury linked to their use followed by the practical instruction on the weapons' use. This training often seems to be missing [5].

We feel that the medical profession has a role to play not only in prevention but also in alerting the authorities so they recognize the potential lethality and damaging risks of this type of weapon. And particularly in France, where the Ministry of Interior considers

these weapons as presenting an “intermediate danger”. In the context of prevention, it is essential to inform users (police, military, etc.) of the very serious injuries these weapons can cause as well as their potential lethality.

The medical point of view would reinforce the precautions of use, making the weapons less aggressive and therefore avoiding tragic consequences.

4. Conclusion

The newly introduced weapon arsenal in the French police, regardless of what they are called, remains weapons. The danger is obviously lesser than for firearms, but they are nonetheless potentially lethal and can cause serious physical injuries.

We must keep in mind that although some are now being re-evaluated, many other weapons in the same category are used daily. Still others are being developed and will soon be on the market with undoubtedly presenting as many risks. Theoretically, simply heeding the precautions of use would reduce lethal risks. But in reality these devices are often used in emergency conditions, under stress and fatigue, leading to precipitation and misuse. If their ban does not seem to be considered today, the training of security forces on using such weapons and their knowledge of the potential damage incurred seem to be the only means of prevention.

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